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LIST OF PLANTS COLLECTED ON THE PEARY ARCTIC EXPEDITION OF 1905-06 AND 1908-09 WITH A GENERAL DESCRIPTION OF THE FLORA OF NORTHERN GREENLAND AND ELLESMERE LAND

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I. GENERAL DESCRIPTION OF THE FLORA*

By the courtesy of the American Museum of Natural History, New York City, two small collections of arctic plants were turned over to the New York Botanical Garden. These collections were made on two of the Peary arctic expeditions in search of the North Pole. The first and smaller was made on the expedition of 1905-06 by Dr. L. J. Wolf; the later and larger in 1908-09 by Dr. J. W. Goodsell. The two collections number together 60 species of flowering plants and ferns. Dr. Goodsell's collection contained 95 numbers, but as he collected at five different places many of the species were represented by more than one number. Except of a few common species the duplicates were not many. Some of the most striking or most characteristic of the plants were exhibited at the American Museum of Natural History at the Peary Exposition last year. The principal set

* Most of this article was given as a paper before the Torrey Botanical Club last year. Although the writer has never visited the arctic regions, more than half of the species discussed are familiar to him from either the Scandinavian mountains or the alpine regions of the Rockies. The general description and the statistics are furthermore abstracted from two excellent works, not generally accessible, viz., *Meddelelser om Groenland*, found only in a few libraries in this country and printed in Danish, and the still rarer *The Vascular Plants in the Flora of Ellesmere Land*, by H. G. Simmons. As descriptions of the arctic regions are very rare, especially in English, it seemed advisable to print this paper in connection with the list.

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is preserved at the New York Botanical Garden, and smaller sets were distributed to Dr. Goodsell, the United States National Museum, the Philadelphia Academy, and the Field Museum, Chicago. As said before, Dr. Goodsell's collection was made at five different stations. Of these three are in Greenland, viz: (1) in the vicinity of North Star Bay (latitude $76^{\circ} 32'$), August 3-6, 1908; (2) in the vicinity of Cape Saumarey (latitude $77^{\circ} 51'$), August 8, 1908; (3) in the vicinity of Etah (latitude $78^{\circ} 20'$), August 6-18, 1908. One station was in the vicinity of Cape Sheridan, Grant Land (latitude $82^{\circ} 30'$), June 15 to July 17, 1909, and the last in a ravine near Battle Harbor, Labrador. All the specimens collected by Dr. Wolf were gathered on the north shore of Grant Land.

It would not be out of the way to say something about the country from which these plants came. Greenland is an island about 23° long and over 50° wide. Of course, at that latitude the degrees of longitude are very narrow. The land is very high on the eastern side. Most of the interior is completely unknown, but many mountains towering over 10,000 feet are known to exist and Petermann's Mountain is estimated at 11,000 feet. The mountains on the west side are evidently lower, the highest known about 5,400 feet. The whole interior is covered with ice or snow. The country evidently slopes somewhat from east to west as the glacier seems to bring more ice down on this side. So far as I know only three expeditions have been made across the country, one in the extreme north by Peary and two in southern Greenland. None have been undertaken in the central portion, which is much higher. A cross country ride in this portion would be a much more strenuous undertaking than Peary's trip to the pole or even Shackleton's travels in search of the South Pole.

The eastern coast, especially the part directly opposite Iceland, is practically unknown.* No vessel has been able even to get near the coast in the last two centuries. There are traditions telling of two settlements made hundreds of years ago from Ice-

* A few expeditions to this part have been undertaken recently, but the reports, if any, have not reached our libraries.

land, and Hans Egede, the first missionary among the Greenland Eskimos, has indicated on his map two churches on the east coast. If there existed any settlement here at Egede's time or not, we do not know. Egede never visited this part of Greenland. He, as well as his son Paul, spent most of his life to an old age among the western Eskimos. One expedition was made some years ago by the Danes and Norwegians along the eastern coast to the part where these old colonies were supposed to have been, but no traces of them were found. At present all the Danish colonies are on the western coast. The most northern one with regular communications, Upernavik, is situated near the 73° parallel, although there is a trading post at Tasinsak about one degree further north. The most northern Eskimo settlement is at Etah near 78° latitude.

The permanent inland ice reaches nearly to the coast and it is only a small strip of the mainland and the islands which become uncovered in the short summer, and it is only where glaciation or erosion has ground the rocks into gravel, sand, or dust, that there is any vegetation at all.

Ellesmere Land is an island situated west of North Greenland, and separated from it by Smith Sound, Kennedy Channel, and Robeson Channel. Kane Basin and Hall Basin are wider parts between the three channels. Ellesmere Land is situated between latitudes 76° and 83° . As several deep bays cut into this island both on the east and the west side, different portions of the same have received different names. The southeastern portion, the one first discovered, received the name Ellesmere Land, the middle portion Grinnell Land, and the northern portion Grant Land. The southern coast has been known as North Lincoln and the southwest end King Oscar Land. As Ellesmere Land was the first name applied to any portion of it by Europeans, it has been adopted for the whole island by the Canadian government. The oldest name is probably "Umingma nuna," the land of the muskoxen, as the Eskimos call it.

Ellesmere Land is not so high as Greenland, the highest point only a couple of thousand feet. There is no continuous inland ice as in Greenland, although smaller ice fields, snow-

covered mountains, and glaciers are found. The flora would probably be much richer if the soil were not so poor and the water supply so limited. In the northern part there is a large fresh-water lake, Lake Hazen.

In the accounts of the flora of Greenland and Ellesmere Land we seldom find any references to the altitude at which the plants grow. Simmons, in his flora of the latter, accounts for this. The occurrence of higher vegetation depends wholly upon soil and moisture. He says: "even at heights of a thousand feet or more, there would be a flourishing vegetation, if only the other conditions were favorable. In few places have I seen such tall grasses as in the plateau of the peninsula between Goose Fjord and Walrus Fjord, at a height of more than 1,000 feet, and often, when after climbing a steep slope of some hundred or a thousand feet, which was very bare except for mosses and lichens, one arrived at a ledge or plateau, one would find a vegetation, which was not any poorer than that near the sea."

West of Ellesmere Land there is another large island, Heiberg Land, perhaps half as large. The flora of this is probably the same as that of Ellesmere Land. This island is practically unknown and no collection of botanical specimens has been made there.

The Labrador coast is very rocky and barren. The inland highland is practically unknown. All botanical collections made in Labrador have been made on the coast, but as Labrador belongs to the subarctic instead of the arctic regions I shall not characterize its flora here. I may only mention that Dr. Goodsell collected here an undescribed plant, of the parsnip family. This was submitted to Dr. J. N. Rose of the United States National Museum, who has furnished a description of it. It belongs to the genus *Conioselinum*.

Greenland has only one plant that forms a tree, *Betula odorata tortuosa*, of which one specimen has been found with a trunk 10 inches in diameter and 12 feet high. It is found as a small tree only at latitude 61° and south thereof, at about the same latitude as Upsala in Sweden, where there are forests of oaks, basswood, and choke cherry. The pine and spruce forests

extend to nearly the farthest point north on the Scandinavian peninsula, *i. e.*, almost to latitude 72° . This is mentioned to show the difference in temperature and climate between northern Europe and the same latitude on this side of the Atlantic. The gulf-stream ends north of Norway and the polar current skirts the east coast of Greenland.

The northern Swedish-Norwegian barley has been tried on Greenland but has failed to ripen even in the most southern part. At all the Danish colonies they have tried to grow gardens to some extent. In the Upernavik district they have failed altogether. At Umanak, near latitude 71° , they can grow green cabbage and radishes and a little lettuce, which does not form heads however. At Ritenbank, near latitude 70° , turnips and dwarf parsley are added. When the country settlers around Godthaab, latitude 64° , go to town, that is the trading post, they bring with them small bouquets of parsley as special gifts to their friends. In the most southern part peas have been grown large enough for the table although they do not ripen. Here there have also been some successful attempts to grow potatoes. But this part of Greenland is outside of the polar circle.

When the vegetable fare is so meager in the Danish colonies what would it be at Etah north of latitude 78° ? Of course, none of our vegetables can be grown, and the native plants fit for food are very few. The only berries reported so far north are the crowberry, *Empetrum nigrum*, scarcely used as a food by white people, and a small blueberry, *Vaccinium uliginosum microphyllum*. The alpine blackberry, *Mairania alpina*, stops at latitude 70° , the common bearberry, *Arctostaphylos Uva-ursi* at $66^{\circ} 40'$, the so-called mountain cranberry, *Vaccinium Vitis-idaea* at 76° , the small cranberry, *Oxycoccus Oxycoccus microphyllus*, at $64^{\circ} 30'$, the blueberry, *Vaccinium uliginosum*, at 64° , the cloudberry or baked-apple-berry, *Rubus Chamaemorus*, at $64^{\circ} 15'$, the dwarf red dewberry, *R. saxatilis*, at $63^{\circ} 30'$. The only plants that can be used for food in the neighborhood of Etah and on Ellesmere Land are *Rhodiola rosea*, a species of stonecrop, of which the thick red root is eaten, mountain sorrel,

Oxyria digynia, of which rootstock and leaves are used, and two species of scurvy-grass, *Cochlearia groenlandica* and *C. fenestrata*, of which the foliage is used. The flower spikes of a lousewort, *Pedicularis lanata*, are also eaten. Among the food plants of more southern parts of Greenland may be counted *Archangelica officinalis* and *Chamaenerium latifolium*, the latter a relative of our fireweed.

As said before, there are no trees in northern Greenland nor in Ellesmere Land. The woody flora consists of a few low bushes and undershrubs. *Betula flabellifolia* extends north to latitude 72°, the other dwarf birches are confined to southern Greenland. Two willows, *Salix groenlandica* and *S. anglorum*, are found in the whole of Greenland and in Ellesmere Land; the latter also throughout arctic America. One sterile specimen collected by Dr. Wolf on Grant Land seems to be *S. arctica*, not known from this region before. *S. herbacea* extends in Greenland north to 76° and *S. glauca ovatifolia* to 72°. The other Greenland willows are confined to the southern portion. None of them are found in Ellesmere Land.

The other undershrubs are the crowberry, *Diapensia lapponica*, and members of the heath and huckleberry families, all mentioned above except *Cassiope tetragona*. A few degrees south of Etah a few more are added, as for instance, *Phyllodoce caerulea*, *Andromeda polifolia*, *Cassiope hypnoides*, *Chamaecistus procumbens*, *Rhododendron lapponicum*, and *Ledum decumbens*. In Ellesmere Land the woody vegetation consists of the three willows mentioned above, *Diapensia lapponica*, *Vaccinium uliginosum microphyllum*, *Cassiope tetragona*, and *Empetrum nigrum*.

Nearly all of the plants of northern Greenland and Ellesmere Land are perennials. The majority are densely tufted or matted plants, some of them making large carpets. Among these can be counted many of the saxifrages and crucifers. Others have rootstocks, often thick and fleshy, as *Rhodiola rosea*, *Oxyria digyna*, several species of *Pedicularis* and *Taraxacum*; sometimes these are more slender, as the species of *Ranunculus*, the sedges, and the grasses.

Lange, in his *Conspectus Florae Groenlandicae*, enumerates about 400 species of flowering plants, but of course the larger number of these are confined to the southern portion. Simmons, in his *Vascular Plants of Ellesmere Land*, enumerates 107 phanerogams. Of these about a dozen are not found in Greenland. There are, however, perhaps a score of species found in northern Greenland not found in Ellesmere Land, and a few have been added since Simmons's publication, so that the North American flora north of latitude 72° may be estimated to about 160 species. Of these about three fifths are circumpolar plants, *i. e.*, plants common to arctic America, Spitzbergen, and Siberia. Of the remaining two fifths, at least half are plants common to arctic America, and the rest divided between truly endemic plants of this region and such as are of European origin, *i. e.*, common to Greenland and Iceland or Spitzbergen.

The families represented in the flora of Ellesmere Land and that of Greenland north of the Danish colonies (*i. e.*, north of latitude 72°) are as follows:

GRAMINEAE.....	20	19	ROSACEAE.....	5	7
CYPERACEAE.....	15	19	EMPETRACEAE.....	1	1
JUNCACEAE.....	3	6	ONAGRACEAE.....	1	1
MELANTHACEAE.....	0	1	PYROLACEAE.....	1	1
SALICACEAE.....	3	6	ERICACEAE.....	1	7
BETULACEAE.....	0	1	VACCINIACEAE.....	1	2
POLYGONACEAE.....	2	3	DIAPENSIACEAE.....	1	1
PORTULACACEAE.....	0	1	PRIMULACEAE.....	1	0
ALSINACEAE.....	7	11	POLEMONIACEAE.....	0	1
CARYOPHYLLACEAE.....	3	4	PLUMBAGINACEAE.....	1	2
RANUNCULACEAE.....	6	8	BORAGINACEAE.....	0	1
PAPAVERACEAE.....	1	1	SCROPHULARIACEAE.....	4	6
CRUCIFERAE.....	13	17	CAMPANULACEAE.....	4	1
CRASSULACEAE.....	0	1	COMPOSITAE.....	4	8
SAXIFRAGACEAE.....	12	12	CICHORIACEAE.....	3	2

110 151

Of these there are 44 species reported for northern Greenland and not for Ellesmere Land, and 12 for the latter that are not found in the former. In the two together there are hence 163 species reported. The Eskimo settlements of Etah and vicinity, visited by the Peary expeditions, are situated between latitudes 76° and 78° , and no plants were collected farther south than 76°

30' except those collected in Labrador. If 76° north latitude would be taken as the southern boundary instead of 72°, I think that the flora of the region would not comprise 100 species in all, as most of the additional Greenland species mentioned above have been recorded only a little north of 72°, and a few of the Ellesmere Land species are limited to the extreme southern portion of that island.

The grasses are all low and not very abundant. Of course, none of them could be used for hay, though they constitute an important part of the summer food for muskoxen and hares. The principal food for the former consists, however, of lichens and mosses. The grasses can be classified into two kinds: (1) The bunch grasses with very short rootstocks and sending up numerous branches from inside the lower sheaths. (2) Those with long stoloniferous rootstocks, forming sods like the Kentucky bluegrass. The former are growing in the gravel beds and among rocks, the latter in richer and moister soil around brooks and springs and below melting snowdrifts.

The sedge family is represented by two species of cotton grass, *Eriophorum*, one species each of *Kobresia* and *Elyna*, the latter genera closely related to the true sedges, *Carex*. The rest of the family consists of species of the latter genus. Most of them grow in the wetter places and have rootstocks.

The Juncaceae, the rushes, are represented by one species of *Juncus* in Ellesmere Land and two in northern Greenland, two species of *Juncoides* or *Luzula* in the former and four in the latter.

No other family of the monocotyledons is represented in Ellesmere Land, except Melanthaceae by one species, *Tofieldia palustris*, in northern Greenland.

The willow family has three representatives in Ellesmere Land and six in northern Greenland. All are low undershrubs. So also is the only representative of the birch family in northern Greenland, viz., *Betula flabellifolia*.

The representatives of the buckwheat family are *Oxyria digyna*, as stated before, one of the food plants, and *Polygonum viviparum*, a common alpine-arctic species. The third representative in northern Greenland is an introduced weed, one of the sorrels, *Rumex Acetosella*.

Montia fontana, a spring plant, *i. e.*, growing in springs, represents the purslane family in northern Greenland.

The chickweed family has seven representatives in Ellesmere Land and eleven in northern Greenland. Except the two species of *Cerastium*, they are very modest looking plants with small flowers and all forming small mats.

The pink family consists of the moss pink, *Silene acaulis*, common also on the higher mountains of this country and Europe, and three species of *Lychnis* or *Wahlbergella*.

The crowfoot family is represented by species of *Ranunculus*, all growing in wet places, especially under melting snow drifts; some of these are rather showy.

The most showy plant of the region is the arctic poppy, *Papaver radicum*. It is rather strange that this genus, belonging principally to warmer countries, should have furnished the plant that above all gives color to the arctic flora. The common poppies of the gardens, the opium plant of India, the wild poppies of central Europe and California, are all leafy-stemmed annuals, but there is a small group of poppies of the arctic and alpine regions, which are perennials with short cespitose rootstocks, crowned by a cluster of finely dissected leaves and naked flower stalks. The stemmed poppies of warmer regions have mostly red, purple, pink, or rarely white flowers. The alpine-arctic poppies range from orange through yellow to white. *Papaver radicum* is common through arctic Europe and America, in the Scandinavian mountains, on Iceland, and in our Rocky Mountains as far south as Colorado. Two closely related species are found in the Alps, another in the Pyrenees, another in the Caucasus, another in the Canadian Rockies and Montana, and two more in Alaska and eastern Siberia. If I do not remember incorrectly, the group is also represented in the Altai Mountains and the Himalayas.

The mustard family is represented by several species of *Draba*, two species of *Cardamine*, two of *Arabis*, two of *Cochlearia*, and one species each of the genera *Lesquerella*, *Eutrema*, *Braya*, and *Hesperis*. The species of *Cochlearia* are interesting, not only from the fact that they are used for food and as a remedy against

scurvy, but more so from the fact that they are, so far as I know, the only annuals of the region.

The only representatives of the stonecrop family is *Rhodiola rosea*, the root of which is eaten. It is not found in Ellesmere Land.

All the representatives of the saxifrage family belong to the genus *Saxifraga*, in the broader sense, except *Chrysosplenium tetrandrum*, collected at one station in southern Ellesmere Land.

The rose family is represented by one species of *Dryas* in Ellesmere Land and two in Greenland. The other members of the family belong to the genus *Potentilla*, all low and tufted species.

The crowberry, *Empetrum nigrum*, is the only representative of its family. The evening primrose family is represented by *Chamaenerium latifolium*, a close relative to our fireweed, and the wintergreen family by *Pyrola grandiflora*. The heath family is represented in Ellesmere Land by a single species, *Cassiope tetragona*, but in northern Greenland by six more species of the genera *Phyllodoce*, *Andromeda*, *Cassiope*, *Chamaecistus*, *Rhododendron*, and *Ledum*.

The huckleberry family has one representative in Ellesmere Land, *Vaccinium uliginosum microphyllum*, and an additional one in northern Greenland, *V. Vitis-idaea pumilum*.

Diapensiaceae is represented by *Diapensia lapponica* in both countries, Primulaceae by *Androsace septentrionalis* in Ellesmere Land, and Polemoniaceae by *Polemonium humile* in northern Greenland.

The Plumbago family is represented by one species of *Statice* in Ellesmere Land and two in Greenland. The only representative of the borage family is *Pneumaria maritima* in North Greenland.

All the representatives of the figwort family belong to the genus *Pedicularis* in the broad sense.

The harebell family is represented by *Campanula uniflora* alone.

The sunflower family is represented in Ellesmere Land by two species of *Erigeron*, one of *Antennaria*, and one of *Arnica*.

The additional species in North Greenland are one species of *Erigeron*, two of *Gnaphalium*, and one of *Artemisia*.

All four members of the chicory family belong to the genus *Taraxacum* of which the dandelion is a member. Of these one has not been found outside of Ellesmere Land and North Greenland, two more are found only there and in arctic America, while the fourth (not found in Ellesmere Land, nor America) is common to Greenland, arctic Europe, and Asia. All four of the arctic dandelions are now represented in the herbarium of the New York Botanical Garden. A few years ago we had only one. Two more were collected by Dr. Wolf and the last one by Dr. Goodsell.

NEW YORK BOTANICAL GARDEN

(To be continued)

NEW COMBINATIONS FROM THE GENUS EUPHORBIA

BY J. C. ARTHUR

The rusts inhabiting the several species of the genus *Euphorbia*, as ordinarily understood, have been variously treated by mycologists. In the recent monograph of the genus *Uromyces* by Sydow, the North American forms having aecia, uredinia and telia are segregated under four species, following the authority of Tranzschel, who in turn based his studies largely upon the published results of cultures made by the writer. In the treatment of this group of rusts in a forthcoming number of the North American Flora, the writer proposes to consider the four species recognized by Sydow as representing "physiological species," or races, belonging to a single species of rust. As these races conform fairly well to the genera into which the genus *Euphorbia* has been segregated, the writer further proposes to use the names of the segregates, rather than list all the hosts, about thirty-five, under the genus *Euphorbia*. A few of these species have not yet been transferred to the segregated genera, and rather than make the transfer of phanerogamic names in a work devoted to fungi, the present method is taken to place the